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AUTHOR Nunes, J. M. Baptista; McPherson, M.; Rico, M.  
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## ABSTRACT

This paper proposes an instructional systems design (ISD) approach for the design and development of a basic Networked Information and Communication Literacy Skills (NICLS) module. It concentrates on the design and development of a NICLS core skills pre-module for the Master of Arts in Information Technology Management (MA ITM) program at the University of Sheffield (United Kingdom). The course is entirely a distance learning program and course participants are professionals in the Information Technology (IT) sector. The need for such courses as pre-modules for online distance education programs for professional adults is presented and discussed. Furthermore, and as a part of the design process, the paper discusses and defines information and communication literacy and its main aspects. The curriculum is designed using an experiential learning approach and the resulting Web-based educational approach is presented and described. (Contains 18 references.) (Author/AEF)

## Constructivist Instructional Design and Development of a Networked Learning Skills (NICLS) Module for Continuing Professional Education Distance Learning

J. M. Baptista Nunes,  
Department of Information Studies  
University of Sheffield  
Regent Court, S1 4DP  
Sheffield, United Kingdom  
Email: J.M.Nunes@sheffield.ac.uk

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M. McPherson  
Department of Information Studies  
University of Sheffield  
Regent Court, S1 4DP  
Sheffield, United Kingdom  
Email: M.A.Mcpherson@sheffield.ac.uk

M. Rico  
Department of Information Studies  
University of Sheffield  
Regent Court, S1 4DP  
Sheffield, United Kingdom  
Email: M.Rico@sheffield.ac.uk

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**Abstract:** This paper proposes an ISD approach for the design and development of a basic Networked Information and Communication Literacy Skills (NICLS) module. The need for such courses as pre-modules for on-line distance education programmes for professional adults is presented and discussed. Furthermore, and as part of the design process the paper discusses and defines information and communication literacy and its main aspects. The curriculum is then designed using an experiential learning approach and the resulting web based educational approach presented and described.

### Motivation

Online environments, and the use of the WWW in online courses, have been seen as the most recent educational panacea to try and provide students with such skills as online communication, online discussion and negotiation of meaning (Bowskill, 1998). The emergence of new educational approaches and epistemologies, such as constructivism and problem based learning, have also been identified as possible ways of fostering and promoting the mentioned skills (Nunes et al., 2000; Pincas, 2000).

As a consequence, students feel compelled to undertake new methods of instruction and provision without being properly equipped with the basic skills required explore a networked learning environment. In fact, students are expected to developed high cognitive skills such as negotiation of meaning, long-life learning, reflective analysis and meta-cognition without being properly trained in low-level skills such as the use of computer mediated technology, online etiquette, web navigation, and web searching. These skills were identified by Nunes et al. (2000) as basic *networked information and communication literacy skills (NICLS)* and are required to succeed in the online learning environment to which students are exposed, but also an essential part of all aspects of daily networked activity.

This paper concentrates on the design and development of a NICLS core skills pre-module for the MA Information Technology Management (MA ITM). The course is entirely a distance learning programme and course participants are professionals in the Information Technology (IT) sector. In previous years, it was assumed that, because of their professional and technical background, they would posses this type of skill, and therefore, that no particular training

was required. This resulted in under-usage of existing online resources and consequently under-performance and failure to match student and tutor expectations.

## Educational Hypermedia Development Methodology

An educational web application can be seen as an instructional system, in the sense put forward by Nervig (1990): as sets of interacting, interrelated, structured experiences that are designed to achieve specific educational objectives, but organised into a unified dynamic whole. Hence, the design of such an hypermedia application should result from the design specifications emerging from the process of analysing curricular problems.

To design and implement these web-based applications, practitioners require instructional systems design (ISD) frameworks. The importance of this overall ISD rests in assuring that the whole environment is implemented using the same learning theory (Nunes, 1999). In fact, if not carefully planned, the web-based environment could result in a mix of eventually conflicting techniques from different theoretical perspectives.

Therefore this paper discusses the design and development of web-based applications for higher education (HE). Academic learning is here seen as an active process in which meaning is developed on the basis of experience, in accordance with the constructivist theoretical frame (Laurillard, 1993). So, to develop web applications in keeping with a constructivist approach, it is important to have an understanding of the kind of specifications that will result from constructivist instructional design (Tam, 2000).

### Constructivist Instructional Design

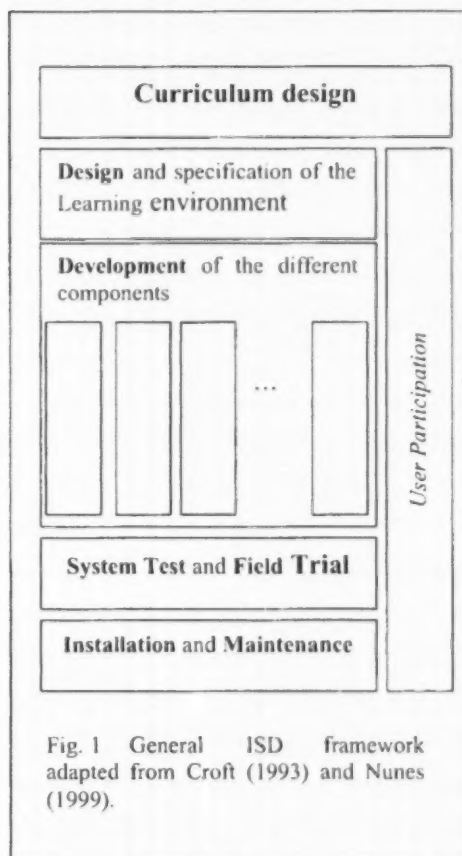


Fig. 1 General ISD framework adapted from Croft (1993) and Nunes (1999).

In the design and development of our web based application the ISD model shown in Fig. 1 was used. Since according to the constructivist philosophy, knowledge domains are not readily separated in the world, information from many sources bears on the analysis of any particular subject matter and it is not possible to isolate units of information. A *central core body of information* must thus be defined in the *curriculum design*, but boundaries of what may be relevant should not be strongly imposed. Instead of dividing the subject matter into logical analysis of dependencies, the constructivist approach turns toward a consideration of what users of that knowledge domain do in real life contexts. The ultimate goal of this approach is to move the learner into thinking in the knowledge domain as if he/she were an expert user of that domain Bednar *et al.* (1992). The designer should then define simplified but still authentic tasks to be experienced by the learner. The goal is to portray authentic learning activities, not to define the structure of learning to achieve the tasks, since it is the process of constructing a perspective or understanding that is important and no meaningful construction is possible if all relevant information is pre-specified (Bednar *et al.*, 1992).

Additionally, curriculum design must ensure that activities are situated in real world contexts, are authentic, and provide multiple perspectives on the subject matter. Some degree of *coaching* or guidance must be provided, by including meaningful examples and the different perspectives of experts and peers. A central strategy for achieving this consists in providing collaborative learning environments including computer mediated communication (CMC) facilities.

CMC allows both peer-to-peer and peer-to-tutor communication. Additionally, access to extra information

sources must be enabled in order to allow different learner's needs to be satisfied.

It is in the *design phase* that all the components of the learning environment required by the curriculum design are defined and specified. During the *development phase* the learning environment is implemented according to the specifications coming from the design phase. Since different types of educational technologies may be needed, to implement all the planned activities, examples and communication channels, different development methodologies may then be applied. Finally the hypermedia application must be system tested and field-tested as an embedded component in the overall learning environment.

### Web Application Development Methodology

The software development methodology that best supports the production of web-based educational applications is the rapid prototyping approach. A rapid prototype is a simplified and untested equivalent of the actual application,

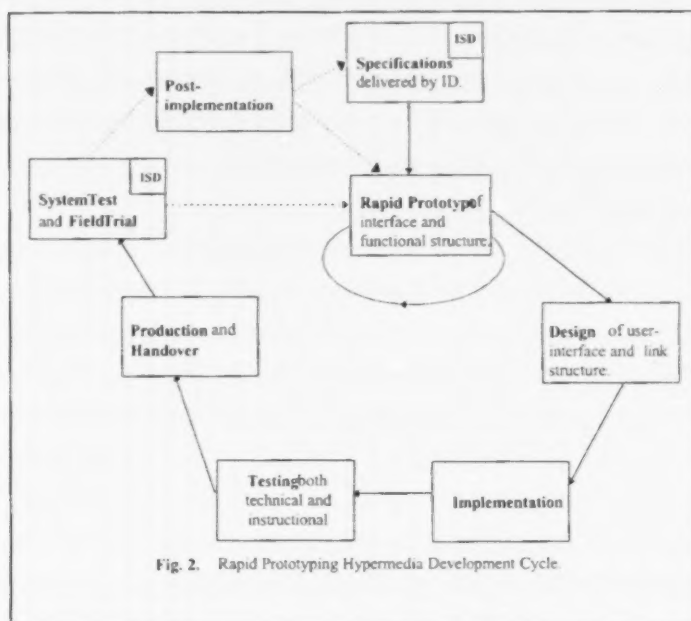


Fig. 2. Rapid Prototyping Hypermedia Development Cycle.

performing all the basic functions specified for the final product (Howell, 1992). As shown in Fig 2, by implementing a prototype first, the hypermedia designers are able to put forward a fully functioning application, presenting all the basic features of the final product such as: user-interface, link structure and coaching facilities. This is not a diagrammatic approximation or representation, which tends to be looked at as an abstract thing, but an actual implementation of the specifications for the application.

These prototypes can be realistically tested and assessed and rapidly changed in an iterative manner until consensus is reached. Evaluation and testing of these prototypes must be done by instructional designers and ideally include pilot tests using target learners. Furthermore, web-based applications are inherently different from other software applications. The volume of actual code produced in scripts is

relatively low and emphasis is put in user-interface design, link structure design and definition of content entry as the different multimedia components. These characteristics, along with widespread availability of authoring tools, make it possible for rapid development and testing of prototypes.

### Curriculum Design for the NICLS Module for Online Distance Education

NICLS can be defined, as the skills required to use networked communication and information technologies to support networked learning activities. Goodyear (2000) defines 'networked learning' as:

"learning in which information and communications technology (ICT) is used to promote connections: between one learner and other learners, between learners and tutors, between a learning community and its learning resources"

(Goodyear, 2000: 9).

Therefore, NICLS can clearly be divided into two main categories: CMC and information skills. CMC skills are related to the interaction of the student with the learning community and have very different features from both written and spoken language as proposed by Yates (1993,1995). Information skills are required due to problems of information anxiety and overload as well as access to the learning resources caused by the erosion of information boundaries (Pincas, 2000).

The curriculum being proposed was based on this theoretical framework as well as a preliminary survey of student requirements. This survey suggests that the latter of the two initial categories identified above, needs to be further subdivided. In fact, students have two main difficulties when using on-line resources: finding and evaluating them. Consequently the syllabus for the NICLS module was designed around the three main topics:

- Online Collaboration and Co-operation;
- Information Searching and Retrieval;
- Evaluation of Networked Information Resources.

### The Pedagogical Approach

A *constructivist pedagogical approach* has been considered for the design of this module. The following assumptions are behind the selection of this approach:

- that learning involves an active process of construction on the part of the learners at individual and social levels, rather than the passive reception of data;
- that the role of the tutor is that of a facilitator to support independent engagement in the process of construction, "scaffolding" the learning environment by providing relevant resources;
- that collaboration and peer support relationships are as essential features as those of the educators in order to engage in dialogs and explore multiple perspectives, exchanging experience, ideas and feedback;
- that learning activities must be authentic and situated within a real context if learning and skills are to be transferred easily into another contexts;
- that course design should engages with learners' individual experiences and encourage ownership of, and motivation to learning.

However, and as discussed by Wilson (1993) constructivism is a philosophy not a strategy, that is, constructivism is an epistemology of learning rather than a framework of teaching (Fosnot, 1996). Consequently as argued by Nunes (1999:53-57), educational practitioners require a clearer educational framework to design their courses.

*Experiential learning* is a framework that can be used as a constructivist tool as described by Nunes and Fowell (1996). This course was designed using this approach. The aim is to encourage participants' awareness of and skills in reflective practice, i.e. learning by doing. Thus, the course has been based in a selection of activities, which aim to encourage learner's engagement with all the phases of the experiential learning cycle.

The course design comprises a blend of activities to set within the same platform in which learners are going to undertake their masters' degree - WebCT. Therefore it promotes a hands-on and authentic learning environment conducive to collaborative learning. The NICLS course was structured according to the course outline presented in Appendix 1.

### NICLS Module Design and Development

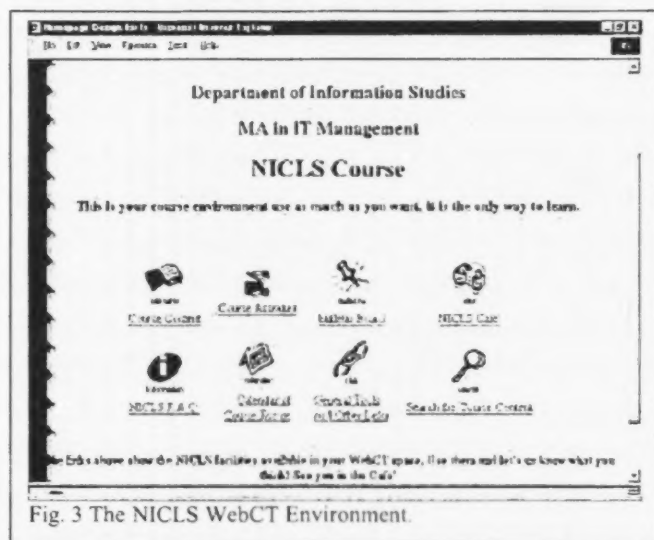


Fig. 3 The NICLS WebCT Environment.

Since the NICLS module is supposed to be a preparation module for on-line learning and in a constructivist environment learning activities have to be situated, it was a natural choice to implement the module using WebCT. Design tasks involved choosing appropriate facilities and WebCT tools. Development consisted in preparing facilities and tools for student use. The resulting environment was prototyped with the participation of both lecturers and current students. An illustration of the current iteration of the course is shown in Fig. 3.

*Course Contents* provides links to resources such as: course overview, course structure, explicit materials for the five units, and a

course map. *Course Activities* provides links to the activities of the week, previous activities and reference materials. The Bulletin Board is used as open posting facility open to all. NICLS Café is an informal social space open to all participants. Specific conferences and chat rooms are created for specific activities. Finally, the NICLS FAQ is a frequent asked questions facility that aims at collecting students questions, comments and anxieties about the course and provide an information repository for reification for future students.

### Conclusion and Future Work

Implementing hypermedia educational applications means much more than just designing a few screens and specifying their sequence (Nunes and Fowell, 1996b). Today, such an approach is not sufficient to support effectively support the learning processes envisaged in constructivist, collaborative or experiential learning philosophies. Understanding the web as an educational technology, and its role within educational practice, is the key to the development of successful learning environments. Moreover, the way to prevent a backlash against the use of this educational technology lies in recognising both the technical and pedagogic components of instructional design and integrating them in a methodologically coherent manner. Rapid prototyping is an ideal approach, which facilitates the integration of the different agents in educational software development: the subject matter experts, the instructional designers and the software developers.

However, designing good learning environments is clearly not enough to guarantee the success of the learning process. In fact, learners that are supposed to use these environments, have to be trained and allowed to acquire the skills needed to be successful on-line learners. The design and development process described in this paper is part of an ongoing research on Networked Learning Support. The module presented is currently being tested with new students enrolling the MA ITM course, prior to commencing their studies. The module and the instructional design process used to design and develop it, need to be carefully and thoroughly evaluated. If successful, this module will be used in all other programs in the Department, and eventually proposed as a University wide elective module. Furthermore, it is thought that, after the evaluation process, both the module and the curriculum will have to be remodelled regularly in order to accommodate the changing characteristics of both learners and networked environment.

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**The University of Sheffield  
Department of Information Studies  
Module Outline 2000-01**

|                 |                                                               |
|-----------------|---------------------------------------------------------------|
| Module Title:   | Basic Networked Information and Communication Literacy (NICL) |
| Module Code:    | ITM000                                                        |
| Pre-Requisites: | None                                                          |
| Status:         | core: MSc ITM approved: MA LIM, MScIM, MSc HIM                |
| Credits:        | 0 credits                                                     |
| Timetabling:    | Induction Period                                              |
| Lecturers:      | Dr. Miguel Baptista Nunes and Ms. Maggie McPherson            |
| Tutors:         | Mariano Rico                                                  |
| Version Date:   | 99.12.15                                                      |

**Aims and Description:**

This module aims to provide learners with a core competence of basic communication and information skills, prior to starting the MA in ITM programme. This will allow students to effectively carry out the course learning activities in the selected web based learning environment with. Consequently, the purpose of this pre-module is mainly to deliver a hands-on experience with the tools and methods for networked learning that are to be used by learners in a web based distance education master's degree course. The module also aims to encourage participants to work collaboratively with their peers, in order to become aware of the potentials and constraints of networked learning.

**Objectives:**

By the end of the course, students be able to:

- Demonstrate proficiency in the use of the technologies used for CMC;
- Show awareness of the social factors affecting CMC;
- Use and comply with the different conventions and etiquette for CMC;
- Effectively communicate and work collaboratively on-line with both peers and tutors;
- Formulate different searching strategies effectively;
- Demonstrate the knowledge of criteria for evaluating online resources;
- Evaluate the validity of search findings.

**Methods/Course Delivery:**

The module will be presented via a combination of online activities and tutorials. It runs for 5 weeks, prior to the start of the first module of the MA in ITM programme. Students are required to spend about 6 hours per week with different learning activities. Since participation is based to a large extent on on-line discussion and activities, students will need to set aside regular and reasonably frequent times for on-line participation. However, although the level of weekly participation is set at 6 hours, students' weekly timetable for the course can be flexible to fit in with changing needs and work patterns.

**Syllabus Content:**

| Week | Theory                                                                                              | Learning Activities                                                                                                         |
|------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| 1    | Introduction to the course and to the ethos of the learning experience. Fundamentals of CMC.        | 1. Email<br>2. Web Conferencing                                                                                             |
| 2    | Synchronous and asynchronous Communication: technical aspects.                                      | 1. Using Chat<br>2. Case Study 1 Discussion                                                                                 |
| 3    | Synchronous and asynchronous Communication: social aspects. Introduction to the Coursework Project. | 1. Case-Study 2 Discussion                                                                                                  |
| 4    | Information Search and Retrieval in Networked Environments.                                         | 1. Using Search Engines<br>2. Using the Library Catalogue<br>3. Formulating Search Strategies<br>4. Case-Study 3 Discussion |
| 5    | Networked Information Evaluation                                                                    | 1. Case-Study 4 Discussion<br>2. Online production of the coursework report.                                                |

**Assessment:**

No formal assessment is proposed for this module. Students will be assessed on a Pass/Fail basis by means of a group project that involves the production of collaborative work.

Further details of the case study forming the basis of the coursework, along with a list of specific deliverables is presented during the week 3.



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